Cultural monitoring of seedlings : a management tool

Slides presented by

Charles-Gilles LANGLCIS, ing.f, *Ph.D.*
Service de ('amelioration des arbres
Direction de la recherche (Forks)
Ministere de l'Energie et des Ressources du Quebec

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CONTENT OF THE PRESENTATION

1- INTRODUCTION

TO MAINTAIN THE PRODUCTIVITY OF HIS NURSERY AND TO MEET HIS OBJECTIVES OF PRODUCTION

THE NURSERYMAN MUST

FOLLOW REGULARLY THE PROGRESSION OF EACH ACTIVITY OF HIS NURSERY

AND HE MUST
CARRY OUT RAPIDLY THE ADJUSTMENTS WICH ARE NECESSARY

ADJUSTMENTS AT THE LEVEL OF

- HUMAN RESSOURCES ;
- MATERIAL RESSOURCES ;
- BUDGETARY RESSOURCES AND ,
- TECHNICAL RESSOURCES ..

IN FACT ,

TO BE EFFICIENT
AND BE ABLE TO REACT RAPIDLY ,

THE NURSERYMAN MUST HAVE

A GOOD SYSTEM OF MANAGEMENT
A GOOD SYSTEM OF CULTURAL MONITORING

SINCE :

THE PURPOSE OF ALL ACTIVITIES IN NURSERY IS TO PRODUCE IN QUANTITY SEEDLINGS OF GOOD QUALITY,

IT IS NORMAL THAT:

THE SEEDLINGS THAT ARE PRODUCED BE INTEGRATED INTO A NURSERY SYSTEM OF MONITORING .

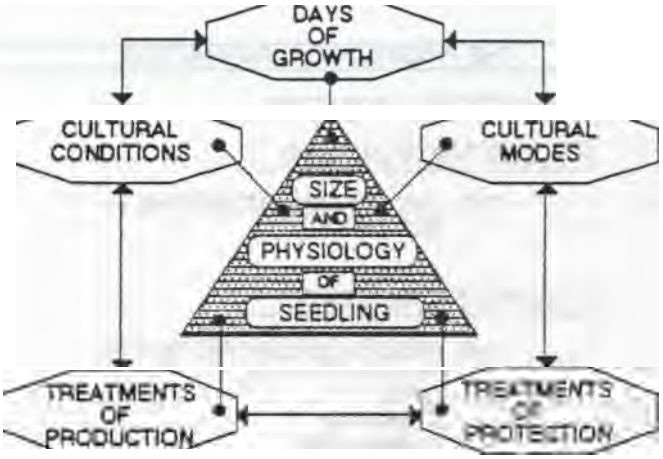
2- OBJECTIVES OF THE CULTURAL MONITORING

THE CULTURAL MONITORING IMPLIES

A DYNAMIC APPROACH IN FUNCTION OF TIME

IT IS BASED ON THE MORPHOLOGICAL AND PHYSIOLOGICAL PARAMETERS OF SEEDLINGS AND , IT DESCRIBES HOW THEY PROGRESS DURING THE SEASON IN FUNCTION OF THE MAIN VARIABLES THAT INFLUENCE THE SEEDLING GROWTH

MAIN VARIABLES OF THE CULTURAL MONITORING



TO BE USEFUL AND EFFICIENT ,THE CULTURAL MONITORING MUST PROVIDE TO THE NURSERYMAN

THE NECESSARY INFORMATIONS

THAT WILL PERMIT HIM

1° TO SYNCHRONIZE IN NURSERIES , DURING THE GROWING PERIOD , THE HUMAN AND MECHANICAL INTERVENTIONS

IN ORDER TO MEET HIS PRODUCTION OBJECTIVES

MEANING :
TO PRODUCE A QUANTITY [X] OF SEEDLINGS FOR EACH SPECIES ACCORDING TO THE MORPHOLOGICAL CHARACTERISTICS REQUIRED [Y1, Y2, Y3,... YN]

2° TO PRECISE THE PHYSIOLOGICAL CHARACTERISTICS [Z1, Z2, Z3,... ZN] OF QUALITY SEEDLINGS

IN ORDER TO INCREASE THE PRODUCTIVITY OF PLANTATIONS.

IN QUEBEC, ALL SEEDLINGS ARE PRODUCED FOR THE GOVERNMENT AND THE LATTER DETERMINES THE MORPHOLOGICAL CHARACTERISTICS TO REACH

3- OBJECT OF THE CULTURAL MONITORING

THE MORPHOLOGICAL PARAMETERS

EVALUATED IN NURSERY :

- THE SHOOT HEIGHT;
- THE ROOT-COLLAR DIAMETER;
- THE SHOOT DRY WEIGHT;
- THE ROOT DRY WEIGHT;
- THE TOTAL DRY WEIGHT;
- THE H/D RATIO;
- THE SHOOT / ROOT RATIO;
- THE HD^2 VOLUME INDEX.

THE PHYSIOLOGICAL PARAMETERS

EVALUATED IN LABORATORY

>> FOR THE OPERATIONS

- THE TISSUES CONCENTRATIONS IN :
  - NUTRIENTS;

>> FOR THE RESEARCH

- THE TISSUES CONCENTRATIONS IN :
  - CARBOHYDRATES;
  - LIPIDS
  - ETHYLENE
  - AMINOACIDS
- THE HYDRIC STRESS

THE MAIN VARIABLES CONSIDERED

- THE CULTURAL MODE;
- THE NUMBER OF CULTURAL DAYS;
- THE NUMBER OF DAYS-DEGREE;
- THE AMOUNT OF NUTRIENTS APPLIED;
- THE FERTILITY OF CULTURAL SUBSTRATE;
- THE AMOUNT OF WATER APPLIED;
- THE TREATMENTS OF PRODUCTION;
- THE TREATMENTS OF PROTECTION.

TO PRODUCE VALUABLES INFORMATIONS

IT IS INDISPENSABLE TO HARVEST THE DATA BY CULTURAL UNIT

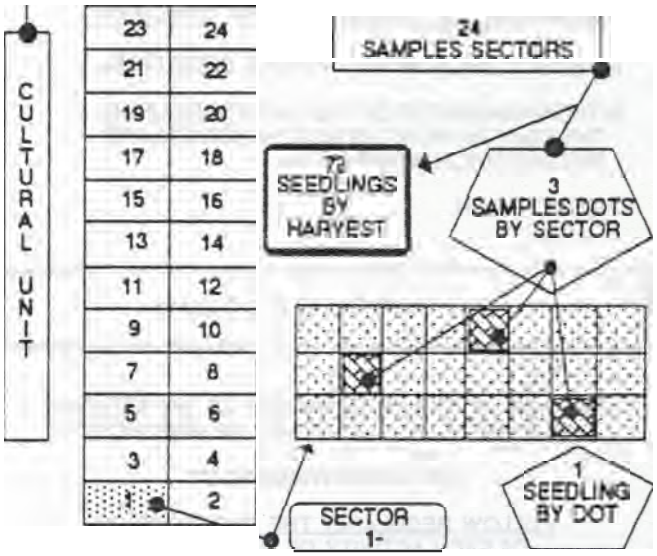
ACCORDING TO

A PRECISE SAMPLES PLAN

A CULTURAL UNIT

REPRESENTS A SURFACE IN CULTURE OCCUPIED BY ONE SEED SOURCE OF SEEDLINGS THAT RECEIVES ALL THE SAME CULTURAL TREATMENTS.

THE SAMPLES PLAN



THE DATA HARVESTED

ARE TREATED IN NURSERY BY USING A COMPUTERIZED SYSTEM FOR THE MANAGEMENT OF SEEDLINGS ESPECIALLY CONCEIVED FOR THIS ISSUE

4- MORPHOLOGICAL MONITORING OF SEEDLINGS

4-1- DURING THE SEASON

- THE MORPHOLOGICAL MONITORING DURING THE SEASON TAKES IN CONSIDERATION
  - THE PROGRESSION,
  - THE INCREASE
  - AND THE SPEED GROWTH OF THE PARAMETERS FOR A SPECIES

IT REPRESENTS

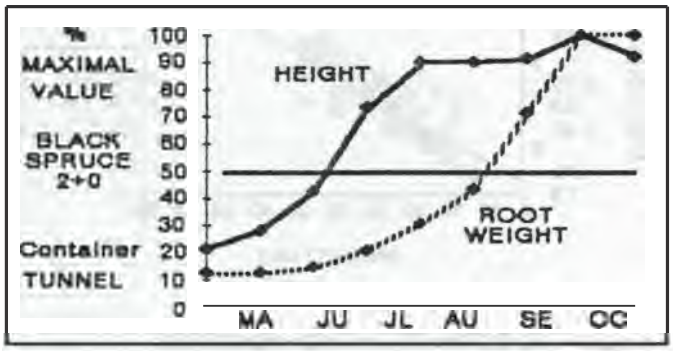
A DYNAMIC REPORT OF A SITUATION THAT EVOLUATES AND THAT CAN BE IMPROVED

AMONG OTHER THINGS, IT PERMITS ...

• 4.1.1- TO QUANTIFY THE GROWTH IN FUNCTION OF TIME
• 4.1.2- TO ILLUSTRATE HOW AND WHEN EACH PARAMETER IS DEVELOPED DURING THE SEASON:

(example)

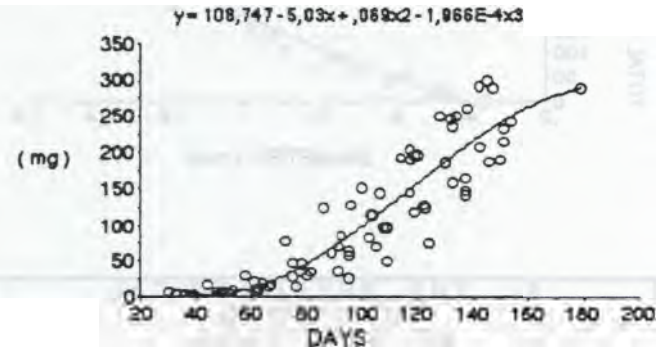
»» THE ROOT WEIGHT DEVELOPMENT OCCURS LATER IN THE SEASON THAN THE HEIGHT GROWTH .



• 4.1.3- TO SUPERPOSE THE DATA OF SIMILAR MONITORING IN ORDER TO ELABORATE THE GROWTH CURVES OF EACH PARAMETERS FOR A SPECIES.

(example)

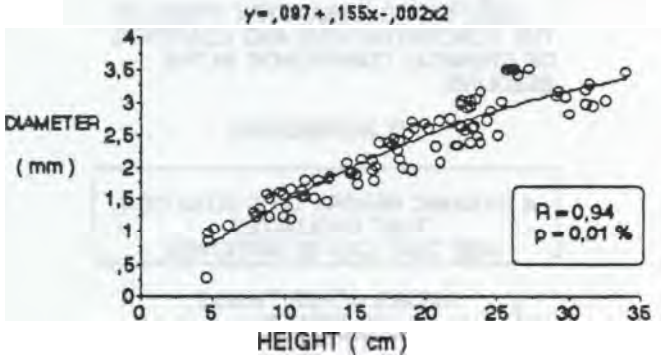
»» THE DEVELOPMENT OF TOTAL WEIGHT (mg), OF BLACK SPRUCE [1+0] IN FUNCTION OF DAYS OF GROWTH



• 4.1.4- TO ESTABLISH THE CORRELATIONS BETWEEN THE PARAMETERS ALONG THE SEASON

(example)

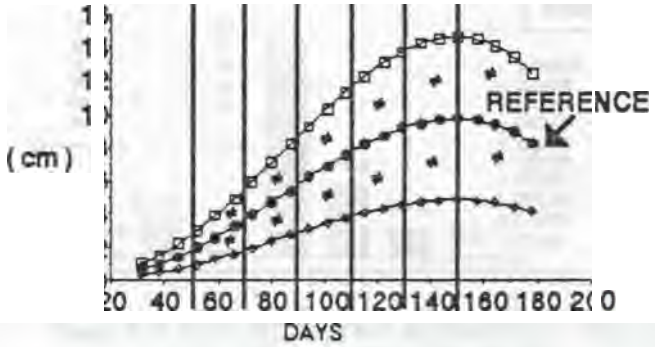
»» IN [2+0], THE BLACK SPRUCE DIAMETER (mm) IS DEVELOPING IN FUNCTION OF THE HEIGHT. (cm)



• 4.1.5- TO MANAGE AT THE APPROPRIATE TIME THE AVERAGE OF A PARAMETER DURING THE SEASON.

(example)

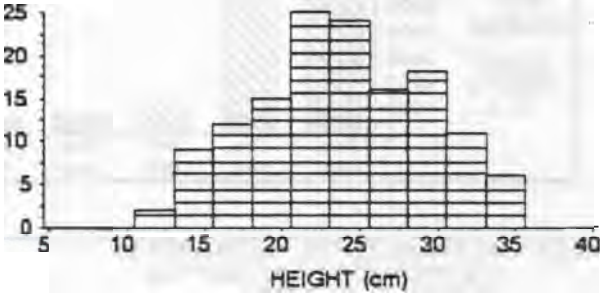
»» THE SHOOT HEIGHT GROWTH (CM) OF BLACK SPRUCE IN [1+0] MUST FOLLOW A REFERENCE CURVE IN ORDER TO AVOID ULTERIOR PROBLEMS IN [2+0].



• 4.1.6- TO MANAGE THE FREQUENCY DISTRIBUTION OF A PARAMETER ALONG THE SEASON

(example)

»» THE AVERAGE SHOOT HEIGHT (cm) OF THE POPULATION IS ELEVATED ENOUGH TO PERMIT TO DELIVER SEEDLINGS WITH THE MINIMAL HEIGHT ?



4- THE MORPHOLOGICAL MONITORING OF SEEDLINGS

4-2• AT THE END OF THE SEASON

THE MORPHOLOGICAL MONITORING AT THE END OF THE SEASON TAKES INTO CONSIDERATION

- THE FINAL VALUES OF EACH PARAMETERS FOR A SPECIES

SO IT REPRESENTS

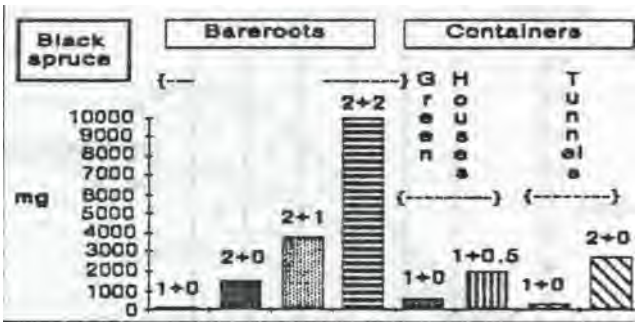
A STATIC REPORT OF A SITUATION

NEVERTHELESS IT PERMITS

• 4.2.1- TO QUANTIFY BY SPECIES THE DIFFERENCES IN FUNCTION OF THE AGE AND THE CULTURAL MODE

(example)

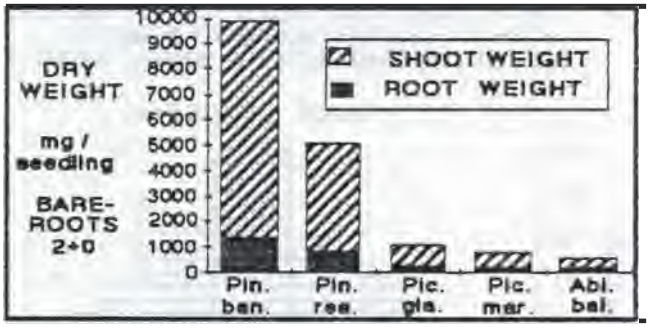
»» THE BLACK SPRUCE FINAL WEIGHT IS CONDITIONED BY THE CULTURAL MODE AND THE AGE.



• 4.2.2- TO COMPARE THE SPECIES WITH THE SAME AGE IN THE SAME CULTURAL MODE

(example)

»» THE 2 YEARS-OLD SPECIES PRODUCED IN BARE-ROOTS CUMULATE DIFFERENT DRY WEIGHTS



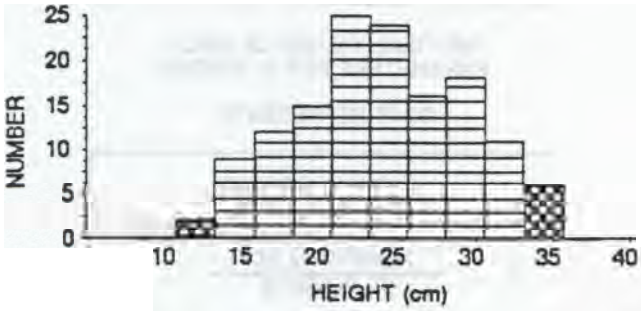
• 4.2.3- TO VISUALIZE THE REGULARITY OF THE FREQUENCY DISTRIBUTION OF EACH PARAMETERS

• 4.2.4- TO EVALUATE THE QUANTITY OF SEEDLINGS THAT DO NOT MEET THE SIZE STANDARDS

(example)

THE DISTRIBUTION OF THE POPULATION HEIGHT IS WIDE, AND THE QUANTITY OF SEEDLINGS, THAT DO NOT CORRESPOND TO THE SIZE STANDARDS IS HIGH.

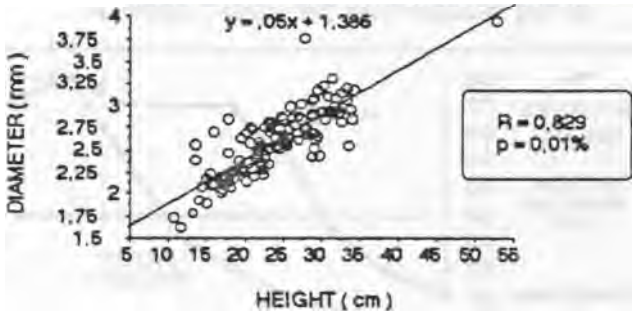
BLACK SPRUCE 2+0



• 4.2.5- TO PRECISE THE MORPHOLOGICAL STANDARDS OF QUALITY FROM THE REGRESSIONS BETWEEN THE PARAMETERS

(example)

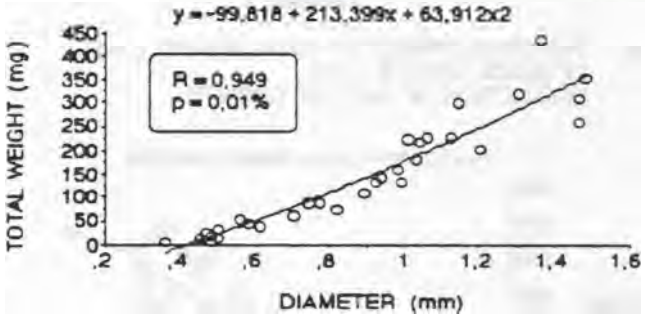
THE BLACK SPRUCE [2+0] DIAMETER (mm) IS CLOSELY RELATED TO ITS HEIGHT (cm).



• 4.2.6- TO ESTIMATE THE NON-MEASURED PARAMETERS.

(example)

»» BY RETAINING A PRECISE DIAMETER (mm) WE DETERMINE THE TOTAL WEIGHT (mg) TO PRODUCE.



5- THE PHYSIOLOGICAL MONITORING OF SEEDLINGS

• DURING THE SEASON

THE PHYSIOLOGICAL MONITORING DURING THE SEASON TAKES INTO CONSIDERATION

- THE PROGRESSION,
- THE INCREASE
- AND THE ACCUMULATION SPEED OF THE CONCENTRATIONS AND CONTENTS OF CHEMICAL COMPOUNDS IN THE SEEDLING.

IT REPRESENTS :

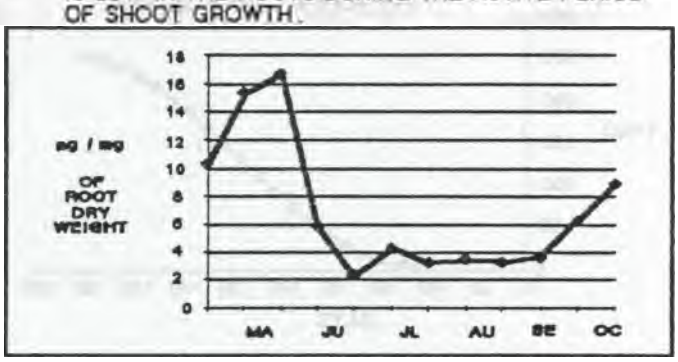
A DYNAMIC REPORT OF A SITUATION THAT EVOLUATES, AND THAT CAN BE IMPROVED.

AMONG OTHER THINGS, IT PERMITS

• 5.1- TO DESCRIBE IN FUNCTION OF TIME OR IN FUNCTION OF THE SEEDLING TOTAL WEIGHT HOW THE TISSUE CONCENTRATION OF A CHEMICAL COMPOUND NORMALLY PROGRESS.

(example)

»» THE STARCH CONCENTRATION IN TISSUES IS LOW IN THE ROOTS DURING THE ACTIVE PERIOD OF SHOOT GROWTH.

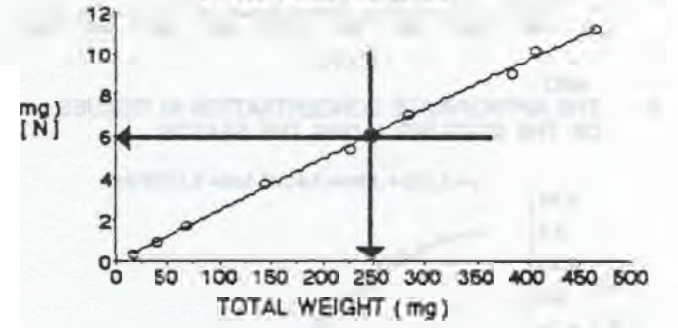


• 5.2- TO QUANTIFY IN FUNCTION OF TIME OR IN FUNCTION OF THE SEEDLING TOTAL WEIGHT THE TISSUE CONTENTS OF A CHEMICAL COMPOUND.

(example)

»» WITH A TOTAL WEIGHT OF 245 mg, A SEEDLING OF WHITE SPRUCE [1+0] CONTAINS 6 mg OF NITROGEN.

y = ,008 + ,026x - 2,078E-5x2

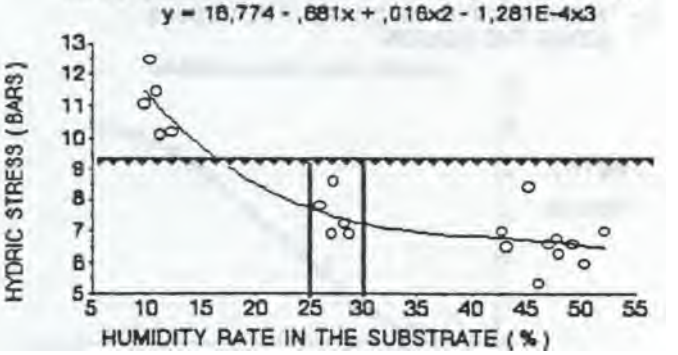


• 5.3- TO IDENTIFY THE SEEDLING NEEDS

(example)

»» A HUMIDITY RATE BETWEEN 25 ET 30 % IS APPROPRIATED IN THE SUBSTRATE TO AVOID AN HYDRIC STRESS TO CONTAINERIZED WHITE SPRUCE [2+0] SEEDLING

y = 16,774 - ,681x + ,016x2 - 1,281E-4x3

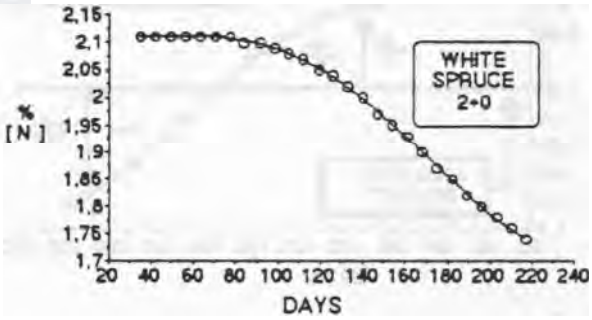


• 5.4- TO SUPERPOSE THE DATA OF SIMILAR MONITORING IN ORDER TO ELABORATE A PHYSIOLOGICAL STANDARD FOR A SPECIES

(example)

»» THE NITROGEN [N] CONCENTRATION IN TISSUES (%) OF CONTAINERIZED WHITE SPRUCE SEEDLINGS [2+0] DECREASES FROM 2,1 TO 1,7 %

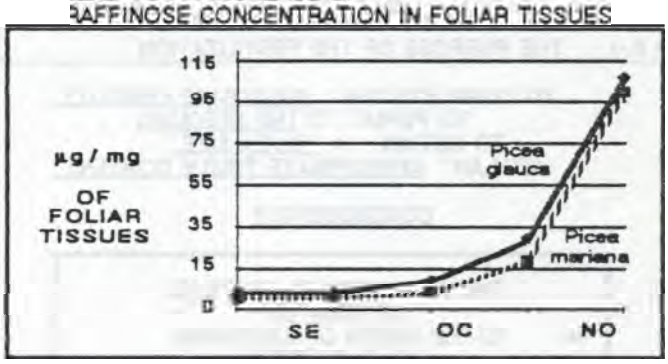
y = 2,14 - ,002x + 5,047E-5x2 - 4,442E-7x3 + 1,006E-9x4



• 5.5- TO VERIFY THE EFFECTS OF CULTURAL CONDITIONS

(example)

»» THE DEGREES OF RUSTICITY LEAD TO AN INCREASE OF RAFFINOSE CONCENTRATION IN FOLIAR TISSUES

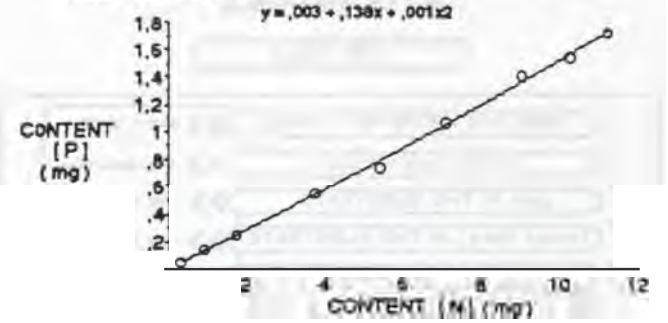


• 5.6- TO ESTABLISH THE CORRELATIONS BETWEEN THE CHEMICAL COMPOUNDS ALONG THE SEASON

(example)

»» IN THE WHITE SPRUCE SEEDLINGS [1+0] TISSUES, THE [P] AND [N] CONTENTS ARE CLOSELY RELATED DURING THE SEASON.

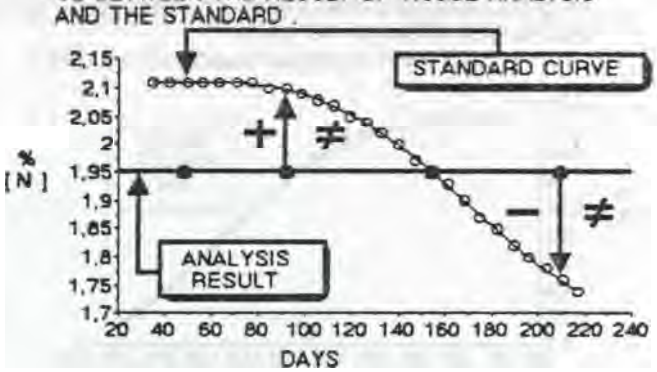
y = ,003 + ,138x + ,001x2



• 5.7- TO MANAGE THE PRODUCTION ALONG THE SEASON IN FUNCTION OF PHYSIOLOGICAL STANDARDS

(example)

»» IT HAS TO BE ADDED OR SUBSTRACTED AT THE NITROGEN [N] QUANTITY TO APPLY, THE DIFFERENCE BETWEEN THE RESULT OF TISSUE ANALYSIS AND THE STANDARD .



6- THE MANAGEMENT OF THE NUTRITION DURING THE SEASON FROM THE MORPHOLOGICAL AND PHYSIOLOGICAL MONITORING

• 6.-1 THE PURPOSE OF THE FERTILIZATION

TO COMPLETE THE " SUBSTRATE FERTILITY "
TO PERMIT TO THE SEEDLING
TO OBTAIN A "GIVEN SIZE "
WITH AN " APPROPRIATE TISSUE CONTENT "

CONSEQUENTLY

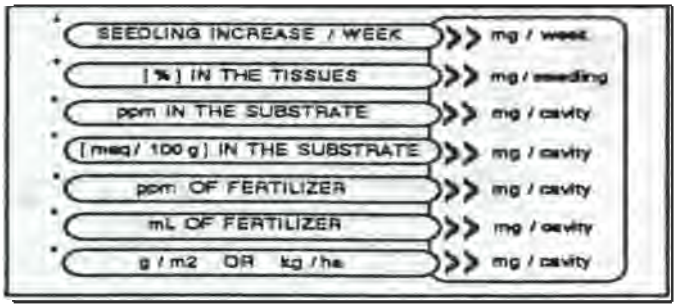
THE NECESSITY TO FERTILIZE IS RELATED
- TO THE NEEDS OF SEEDLINGS AND IS FUNCTION
- OF THE SUBSTRATE FERTILITY
- AND THE TISSUE CONCENTRATION

THE ORIGINALITY OF THE APPROACH

CONCERNING THE FERTILIZATION OF CONTAINERIZED SEEDLINGS

IS BASED ON THE UTILIZATION OF ONLY ONE UNIT OF REFERENCE

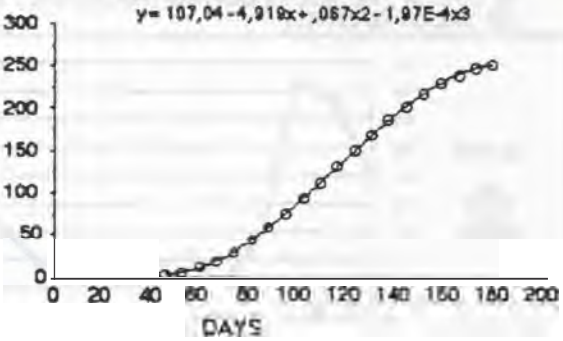
THE [MG]



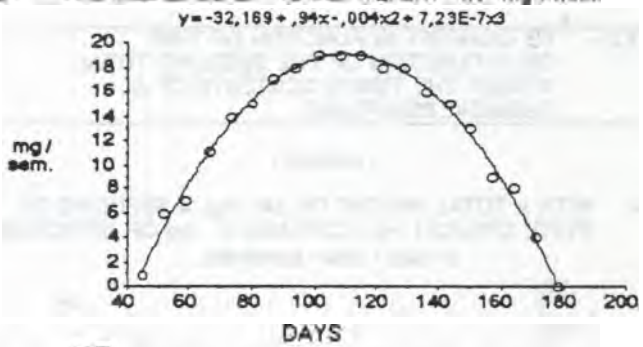
• 6.-2 THE STRUCTURAL NEED OF SEEDLING

THE CALCULATION OF THE STRUCTURAL NEED CONSIDERS :

1• THE DEVELOPMENT OF THE TOTAL WEIGHT IN mg ALONG THE SEASON

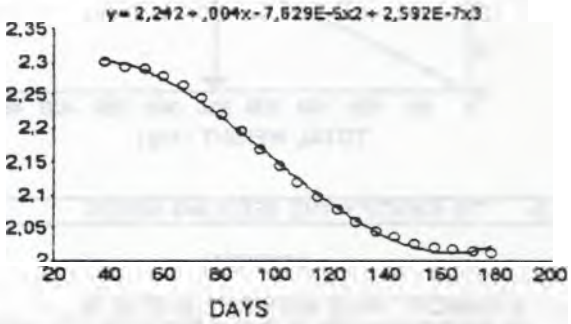


2• THE INCREASE OF TOTAL WEIGHT IN mg / week



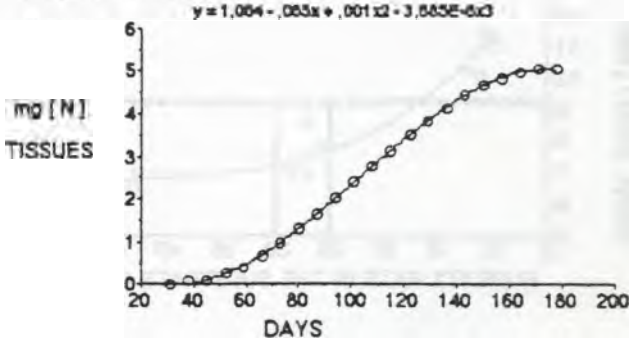
AND

3• THE APPROPRIATE CONCENTRATION IN TISSUES OF THE SEEDLING ALONG THE SEASON

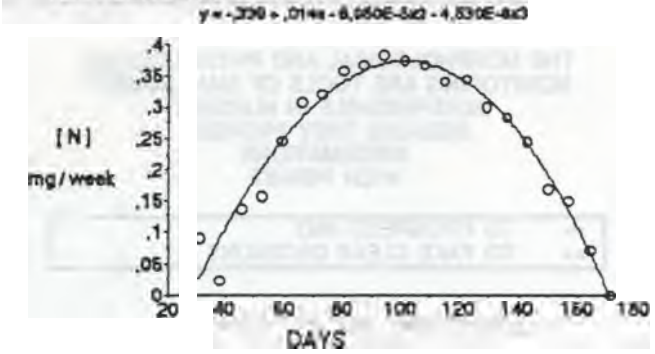


IT EVALUATES

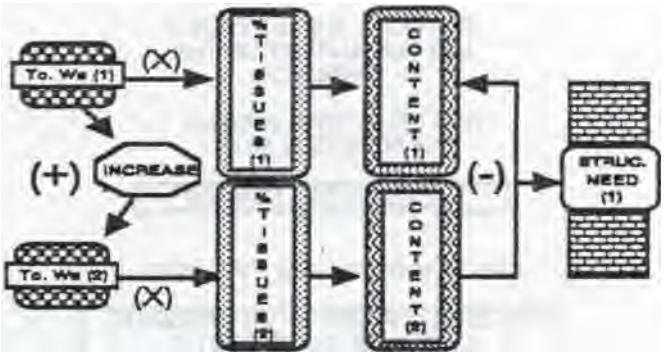
1•.- THE APPROPRIATE CONTENT IN TISSUES ALONG THE SEASON.



2- AND
THE WEEKLY NEED IN mg [N] / week
ALL ALONG THE SEASON



GRAPHICALLY



• 6.-3 THE TOTAL NEED OF THE SEEDLING

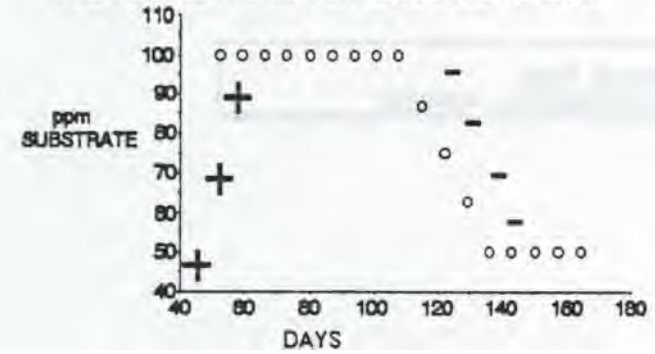
IN ORDER TO ABSORB THE NUTRIENTS APPLIED,
THE SEEDLINGS
MUST BE GROWN IN

A SUBSTRATE WICH CONTAINS
AN APPROPRIATE FERTILITY LEVEL

• THE PEAT MOSS SUBSTRATE CONTAINS
GENERALLY
LOW CONCENTRATIONS OF NUTRIENTS,

SO, THE FERTILITY OF THE SUBSTRATE
HAS TO BE TAKEN INTO CONSIDERATION.

»» IN THE BEGINNING OF THE SEASON
INCREASE THE SUBSTRATE FERTILITY
AND REDUCE IT LATER ON ALONG THE SEASON.



IF ALL THE NUTRIENTS ADDED
WERE ABSORBED

• THE STRUCTURAL NEED
AND
• THE MANAGEMENT OF THE SUBSTRATE FERTILITY
WOULD BE SUFFICIENT;

HOWEVER, ESPECIALLY IN [1+0]
TO

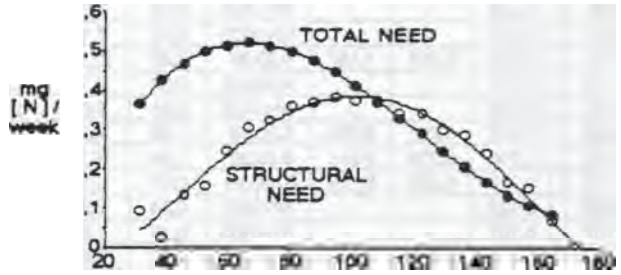
• FAVOUR THE ABSORPTION AT THE BEGINNING OF
THE SEASON, WHEN THE ROOT SYSTEM DOES NOT
OCCUPY ALL THE VOLUME
OF THE CONTAINER CAVITY
AND TO

• REMEDY TO THE IMPRECISION OF THE DISTRIBUTION
SYSTEM FOR THE FERTILIZERS

IT IS NECESSARY TO CONSIDER

»» A UTILIZATION FACTOR OF FERTILIZERS

»» THE WEEKLY TOTAL NEED, ALL ALONG THE SEASON,
PROVIDES THE DISTRIBUTION CURVE OF THE
FERTILIZER DURING THE SEASON



TOTAL NEED CALCULATION

Black Spruce = 251 mg in Container 45-110

Day	Structural Need [N] mg / week	Need Substrate Fertility mg [N]	Σ Structural Fertility mg [N]	Utilization Factor	Total need [N] mg / week	Total need [N] mg / week
	mg = 50,3 ppm		100 ppm = 1,2 mg			Reg'season
31	0,092		0,092	1,3	0,120	0,362
38	0,023	0,400	0,423	1,3	0,550	0,423
45	0,137	0,400	0,537	1,3	0,698	0,468
52	0,158	0,400	0,558	1,3	0,726	0,498
59	0,247		0,247	1,3	0,321	0,515
66	0,308		0,308	1,3	0,400	0,520
73	0,323		0,323	1,3	0,420	0,514
80	0,359		0,359	1,3	0,467	0,498
87	0,370		0,370	1,3	0,481	0,475
94	0,384		0,384	1,3	0,499	0,446
101	0,375		0,375	1,3	0,488	0,411
108	0,370		0,370	1,2	0,444	0,372
115	0,343	-0,150	0,193	1,2	0,232	0,331
122	0,344	-0,150	0,194	1,2	0,233	0,288
129	0,300	-0,150	0,150	1,2	0,180	0,246
136	0,285	-0,150	0,135	1,2	0,162	0,206
143	0,244		0,244	1,2	0,293	0,168
150	0,168		0,168	1,1	0,185	0,135
157	0,152		0,152	1,1	0,167	0,107
164	0,071		0,071	1,1	0,078	0,086
171	0,000		0,000	1,1	0,000	0,000
Σ	5,053	0,600	5,653		7,142	7,069

• 6.-4 THE FERTILIZATION SCHEDULE

THE CHOICE OF PRODUCTS TO USE,
IN ORDER TO APPLY THE WEEKLY NEED IN [N]
TAKES INTO CONSIDERATION

• THE STRUCTURAL NEED IN [P] AND [K]
AND THE
• UTILIZATION FACTOR
OF EACH OF THESE ELEMENTS

PRELEVERTILIZATION SCHEDULE
BLACK SPRUCE: 354 mg OF DRY WEIGHT
45 - 110

Day	N	P	K	PRODUCT			[N]
	mg / cavity			Name	g / m2	kg / ha	kg / ha
31	0,362	0,393	1,126	8.20.30	2,77	27,69	2,22
38	0,423	0,460	1,315	8.20.30	3,24	32,36	2,59
45	0,466	0,509	1,456	8.20.30	3,56	35,60	2,86
52	0,496	1,130	0,413	10.52.10	3,05	30,48	3,05
59	0,515	0,225	0,427	20.20.20	1,58	15,76	3,15
66	0,520	0,227	0,432	20.20.20	1,59	15,91	3,18
73	0,514	0,225	0,427	20.20.20	1,57	15,73	3,15
80	0,496	0,218	0,413	20.20.20	1,52	15,24	3,05
87	0,475	0,208	0,394	20.20.20	1,45	14,54	2,91
94	0,445	-	-	NH4NO3	0,78	7,80	2,65
101	0,411	-	-	NH4NO3	0,72	7,18	2,44
108	0,372	0,404	1,157	8.20.30	2,85	28,46	2,28
115	0,331	-	-	NH4NO3	0,58	5,79	1,97
122	0,288	-	-	NH4NO3	0,50	5,03	1,71
129	0,246	0,267	0,765	8.20.30	1,88	18,82	1,51
136	0,206	0,224	0,641	8.20.30	1,58	15,76	1,26
143	0,168	0,073	0,139	20.20.20	0,51	5,14	1,03
150	0,135	-	-	NH4NO3	0,24	2,36	0,80
157	0,107	-	-	NH4NO3	0,19	1,87	0,64
164	0,086	0,038	0,071	20.20.20	0,26	2,63	0,53
171	0,000	-	-	-	0,00	0,00	0,00
Σ	7,07	4,60	9,18		30,43	304,34	42,96

7- CONCLUSION

THE MORPHOLOGICAL AND PHYSIOLOGICAL
MONITORING ARE TOOLS OF MANAGEMENT
INDISPENSABLE IN NURSERY
BECAUSE THEY PROVIDE
INFORMATIONS
WICH PERMIT

» TO PROGRESS AND
» TO TAKE CLEAR DECISIONS

CONCERNING THE ART TO PRODUCE
EACH SPECIES

TO PROFIT THE EFFICIENCY
AND THE RAPIDITY OF THE
APPROACH

IT IS MORE THAN WISHING
TO INTERVENE WITH

THE COMPUTER SCIENCE

THIS IS WHY, WE ARE FINALIZING

THE DEVELOPMENT OF AN INTEGRATE
SYSTEM OF COMPUTERIZED
MANAGEMENT OF THE TECHNICAL DATA
IN NURSERY

IN QUEBEC
THE NURSERIES THAT REALIZE
THE CULTURAL MONITORING

ARE AMONG THE MOST PERFORMANT

THEN, I INVITE YOU
TO USE
THIS TOOL OF MANAGEMENT

SPECIAL THANKS TO MY TECHNICAL TEAM
AND TO THE TECHNICAL TEAM OF EACH GOVERNMENTAL NURSERY